

and so it may easily be the case that at solar temperatures certain of our terrestrial elements cannot exist, or, if they exist at all, can do so only in certain very restricted regions of the solar atmosphere.

"One strong argument in favour of this view is found in the fact, now we think beyond dispute, that the same substance may, under different circumstances, give widely different spectra. . . ."

"There seem to be at least three possible explanations of these facts. One is, to suppose that the luminous substance, without any change in its own constitution, vibrates differently and emits different rays under varying circumstances, just as a metal plate emits various notes according to the manner in which it is held and struck. The second assumes that the substance, without losing its chemical identity, undergoes changes of molecular structure (assumes allotropic forms) under the varying circumstances which produce the change in its spectrum. According to either of these views, although we can safely infer from the presence of the known lines of an element in the solar spectrum, its presence in the solar atmosphere, we cannot legitimately draw any negative conclusion; the substance may be present, but in such a state under the solar conditions as to give a spectrum different from any with which we are acquainted."

"The other and simplest explanation is to suppose, with Mr. Lockyer, that the changes in the spectrum of a body are indications of its decomposition, the spectrum of the original substance being replaced by the superposed spectra of its constituents."

"Another point which favours Mr. Lockyer's view is this: Certain substances have numerous lines apparently common. Thus, if one runs over Ångström's map of the solar spectrum, he will find about twenty-five lines marked as belonging both to iron and calcium. The same thing is true of iron and titanium to a still greater extent, and to a considerable degree of several other pairs of substances. This fact might be explained in several ways. The common lines may be due, first, to impurities in the materials worked with; or, second, to some common constituent in the substances (which is Mr. Lockyer's view); or, third, to some similarity of molecular mass or structure which determines an identical vibration-period for the two substances; or, finally, it may be that the supposed coincidence of the lines is only apparent and approximate—not real and exact—in which case a spectroscope of sufficient dispersive power would show the want of coincidence."

"Now, Mr. Lockyer, by a series of most laborious researches, has proved that many of the coincidences shown on the map are merely due to impurities. . . . But when all is done, we find that certain of the common lines persist, becoming more and more conspicuous with every added precaution taken to insure purity of materials.

"Moreover, when one of the substances, say the calcium, is subjected to continually increasing temperatures, its spectrum is continually modified, and these basic lines, as Mr. Lockyer calls them, are the ones which become increasingly conspicuous, while others disappear. This is just what ought to happen if they are due to some element common to both iron and calcium—an element liberated in increasing abundance with every rise of temperature" (pp. 89-92).

"A given element often has several entirely different spectra. Changes, such as have been mentioned, go on up to a certain point, and then, suddenly, an entirely new spectrum appears, not having apparently the slightest connection with the one which preceded it any more than if it came from an entirely different element or mixture of elements; as, in fact, according to Mr. Lockyer's view, is probably the case.

"Now, in the solar spectrum, the dark lines characteristic of an element are all coincident with the bright lines of its gaseous spectrum; but it is not often the case

that the relative width and intensity of the solar lines match those of the bright lines in the spectrum obtained by artificial means" (pp. 96-97).

"In the motion-distortions of lines Lockyer finds strong confirmation of his ideas. It not unfrequently happens that in the neighbourhood of a spot certain of the lines which we recognise as belonging to the spectrum of iron give evidence of violent motion, while close to them other lines, equally characteristic of the laboratory spectrum of iron, show no disturbance at all. If we admit that what we call the spectrum of iron is really formed in our experiments by the superposition of two or more spectra belonging to its constituents, and that on the sun these constituents are for the most part restricted to different regions of widely varying pressure, temperature, and elevation, it becomes easy to see how one set of the lines may be affected without the other" (p. 100-101).

It will be gathered then from these extracts that in Prof. Young's opinion, whatever that opinion may be worth, and we for our part attach great value to it, the new hypothesis does get rid of a good many of the difficulties of the old one, and surely this is the best justification any worker in science can have for suggesting an hypothesis. It is to be noted also that several of the various converging lines of evidence, especially those depending on the changes in spectra, are referred to. It is imagined by some that the new hypothesis breaks down if a line apparently coincident in the spectra of two substances at small dispersion should turn out to be non-coincident when a higher power is employed, while the fact is that the assumption that there should be such coincident lines, if *we can reach a particular temperature*, is based upon one manner of behaviour of compound bodies to the exclusion of another, and on such points as these we are as yet in profound darkness.

The chapter on the sun's light and heat, and the appendix on Prof. Langley's recent work will well repay perusal.

THUDICUM'S ANNALS OF CHEMICAL MEDICINE

Annals of Chemical Medicine. Vols. I. and II. By J. L. W. Thudicum, M.D. (London: Longmans, Green and Co., 1879.)

THOSE who open this work expecting to find it adequately fulfilling the promise of its title will be disappointed. Had they read the initial preface they would have been prepared for this, for it indicates very clearly the intention of the promised series, of which the first two volumes are now published.

Dr. Thudicum is well known as the author of numerous researches in Animal Chemistry, which are chiefly remarkable for the large number of new bodies described in them, and the somewhat fantastic names he has assigned to these bodies. Somehow or other the results of these researches have not met with that general acceptance which their author desires; indeed they have in many cases been either to a great extent passed over or else their value called into question by those who have repeated his experiments or worked at the same parts of the subject. This is clearly recognised by the author in the preface to the first volume, and has accordingly led him, on the assumption that one cause, among

others, of this neglect is the scattered nature of his publications, to commence republishing his researches in a "consolidated" form with the addition of new work. Whether this will in future prevent the neglect under which the author feels he has laboured remains to be seen; that he himself so far is satisfied with the results following the appearance of the first volume is evident from the preface to the second.

The only original matter in these volumes other than that of the author consists of one short note by the author's son, so that there has apparently been no response to the invitation to contribute to these "Annals" which was issued with the first volume.

The larger part of each volume is made up of a series of summaries of work which has been done in various branches of Physiological Chemistry; these contain a good deal of information of a fragmentary kind, but can scarcely be regarded as adequately presenting to the reader the present state of opinion on the subjects of which they treat. This is especially the case in the summaries contained in the second volume. "Visual-purple" receives very rough treatment in Article III.; the account of researches on the source of urea in the body is anything but complete, and the same may be said of Article XVIII., on fibrin and its precursors. It is, however, only fair to say that many of the summaries are much less open to objection.

The preface to the first volume contains a charge of malevolent and ignorant opposition to the author's work, which reaches its full development in his concluding remarks to Article XIX., on the existence of Protagon; in these he accuses those whose work is opposed to his own, not only of incompetence, but of what is best known as "cooking"; he speaks of them as obtaining "extracts of uniform composition" "by the aid of processes nearly akin to trimming." The reference is obvious. Similarly in the second volume, Article XVI., "Modern Text-Books as Impediments to the Progress of Animal Chemistry," consists of a review of Prof. Gamgee's "Text-Book of Physiological Chemistry," in which this work is characterised as "humiliating to scientific literature." Comment on this article may safely be left to the individual judgment of those who take the trouble to read it. It may, however, not be out of place to suggest here that a continuance of this tone in future volumes towards those whose work is at variance with the author's, will undoubtedly do much to alienate from him any sympathy with the "Annals" which physiologists might otherwise have been inclined to extend to them.

OUR BOOK SHELF

Kufra. Reise von Tripolis nach der Oase Kufra. By Gerhard Rohlfs. With Eleven Drawings and Three Maps. (Leipzig: F. A. Brockhaus, 1881.)

THIS new volume of travels by Dr. Gerhard Rohlfs is a valuable contribution to a knowledge of the southern parts of the Vilayet of Tripolis and of the Lybian Desert. In December 1878, Herr Rohlfs, accompanied by Dr. Stecker, started from Tripoli, and soon reached the interesting oasis of Djofra, or Sokna, already known from the travels of many Europeans. Thence he proceeded east-south-east to Aujila, crossing the formerly quite unknown tracts of the sandy and stony deserts situated at

the north-eastern foot of the Black Mountains. He reached the green and pretty oasis of Sella, which is one of the richest of the Eastern Sahara, and has no less than 100,000 palm-trees, and large flocks of camels. Going further east to Abu-Naim, Herr Rohlfs did not follow the usual route, but, avoiding encounters with robbers, he made a great bend towards the south, having thus the opportunity of visiting the hilly tracts of the spurs of the Harauj-assod Mountains, watered during the rainy season by numerous Wadi. On March 24, 1879, he reached the small but wealthy Abu-Naim, whose numerous fossils, as well as foraminifera scattered in its sands, will probably attract the attention of future explorers, Herr Rohlfs' collection having been plundered by robbers. A few days later he was in Aujila, which he already had visited in 1869. But his further advance being checked by the fanaticism of the inhabitants, he was compelled to send Dr. Stecker, and one month later to go himself to Bengasi, on the Mediterranean coast, to obtain there some protection for his journey to Kufra. It was only in July that he was enabled to return to Aujila, and to start for Kufra, 350 kilometres distant due south of Aujila. The oasis, situated between 26° and 24° N. lat., and 21° to 24° E. long., is elevated 250 to 400 metres above the sea-level, and is far larger than it was expected, as it covers 17,818 square kilometres. It must have been once a great salt lake, and even now it is covered with brackish marshes, and has a small lake; but sweet water is found everywhere in this oasis at a small depth, and throughout its length and breadth it is covered with vegetation. From Kufra Herr Rohlfs returned to Bengasi, after his caravan had been plundered by the inhabitants.

The work contains interesting observations on the sinking of the North African coast, and gives a good description of the physico-geographical conditions of the Eastern Sahara. There are illustrations and a map of the region visited, and more detailed maps of Djofra and Kufra. In the second part of the book we find a list of new routes in Tripolitania; a list of temperatures of wells, observed by Dr. Stecker; a paper on altitudes and on meteorological observations by Dr. Flann; papers on the Amphibia and Arthropoda collected by the Expedition, by Dr. Karsch; and an elaborate paper, by Dr. Ascherson, on the plants collected during the last seventy years in Central Africa—the catalogue of Dr. Ascherson mentions 437 plants from Tripolitania, 200 from Fezzan, 48 from the Aujila oases, and 493 from Cyrenaica.

Tables of Qualitative Analysis. By H. G. Madan. (Clarendon Press, Oxford, 1881.)

IT is surely high time that students of chemistry were taught qualitative analysis by some other method than by following a very complicated table of analysis. That very important stage of chemical learning, qualitative analysis, would be much more thoroughly mastered if the student were well exercised in the reactions of the elementary substances, and then led to construct methods of separation himself. He would by this means become independent of tables and books in the laboratory. Students who are accustomed to work with, or follow, a table, often lose much time in finding where they are working on the table, and get on the "left side" of the group when they should be on the other. The tables before us would doubtless be useful to an advanced student, but appear certainly very complicated to be put into the hands of a beginner. No notice is taken of the so-called rare elements, but a good table of solubilities is supplied—a part of an analysis book that students might benefit by consulting a little oftener than is usually the case. Although produced in the usual good style of the Clarendon Press, a somewhat smaller form would perhaps be more convenient for use on the laboratory benches.